



IOT BASED SMART SHOE FOR VISUALLY CHALLENGED PEOPLE

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Abstract

Sight is one of the most powerful senses of a human being. Unfortunately, some people have various challenges caused due to impairment on their organs. Visually challenged is one of the important challenges faced by the people and they face many issues based on obstacles in their movement both internally and externally. For their daily life, they are always dependent on others. Visually challenged people face many accidents and they often fall down. A failure in adapting to the new surroundings can lead to getting them lost in unknown areas. "Smart Shoes" are specially designed to provide a better mobility solution for the visually impaired to travel safely and freely. It is built with "Internet of Things" technology and the shoes are embedded with Microcontroller, Ultrasonic Sensor, Vibration Sensor, Node MCU. The Smart Shoes alerts the visually challenged people when an obstacle is detected while they walk with the Smart Shoes. Smart shoes are designed to be safe and a convenient companion in their daily life activities. As a result, there is a fully adaptive model developed to improve the quality of life and comfort of the visually challenged.

Keywords: Smart Shoe, Visually Impaired, wearable, Obstacles, Detection, Internet of Things (IOT) Sensors

1. INTRODUCTION

Blindness is a visual impairment which cannot be corrected with glasses or contact lenses. It can be categorized into Partial Blindness and Complete Blindness. Partial Blindness have low vision whereas complete blindness does not have any vision. When a person enters an unfamiliar place, he must first search to reach the destination guidance from others. Visual impairment is defined as congenital or subsequent loss of vision. The visually challenged people constitute the substantial majority of the world's population People who are completely blind or have poor vision generally struggle to move outside of their familiar environments. In fact, one of the main difficulties for blind persons is physical movement. Travelling or even just walking on a busy street can be challenging. As a result, many people with impaired vision choose to travel with a sighted friend or relative when exploring new environments.

39 million people are blind and 284 million are visually challenged, according to a report by the World Health Organization. According to some estimates, 20% of vision can be prevented, and 60% of blindness can be cured and 82% of those who are blind are 50 years of age or older. The impact of growth in modern technology has peaked, the need for an intelligent system to assist the challenged. IoT based Smart Shoe for Blind People refer to an automated way to help the visually challenged people. This project enables an obstacle detection system for the blind people with help of obstacle detection sensors and vibrating sensor. The extreme development in the field of technology has kindled the improvement in daily life activities. The internet of things is effective at finding activity that serves a purpose. The smart shoe is a piece of safety gear that includes an obstacle detection sensor and a node MCU. The use of a vibration sensor will enable persons who are blind to detect obstacles through the vibration of their shoes.

2. LITERATURE REVIEW

Singh et al., [1] proposed the use of ultrasonic sensors. The ultrasonic sensors are the main obstacle detection device here. It sends an echo signal & from that calculates the total distance of an object from shoes. It offers lots of advantages over a blind stick. Such kinds of shoes make hands free which can be can utilize them for holding any stuff or railing while ascending or descending the stairs. The shoe also includes sensors to detect obstacles such as sidewalks, staircases, etc. Ultrasonic sensors calculate the distance of the hurdles present in the way.

Zhao et al., proposed wearable smart shoe technology for health and fitness purposes using IOT. The sensors used are interfaced with an Arduino which is responsible for sending and receiving data. Accelerometer calculates footstep count, distance travelled and total calories burned and this data is stored in Arduino and send to the android device by using a Bluetooth module embedded in the shoe. Another feature added in the shoe is the Piezo electric device which charges USB devices when a user walks around. It also consists of a GSM safety module. Entire data received from the wearable sensors is displayed on the android device and the end-user can view and access it [2]. Ahmad at al., proposed a system that uses servo motors and ultrasonic sensors to detect obstacles in the environment and cover that much area as possible with the motor. They are connected to buzzers that tell the user of the closest object that is within hearing distance of the location. The user is supposed to become independently and to be protected from problems that may be fatal. It comprises of a pair of smart shoes and smart glasses [3].

Jang et al., proposed wearable smart shoes for using IOT [4]. The shoes are embedded with various sensors, microcontroller, buzzer, speaker and vibration motor. It will detect the obstacles within the specified distance. The shoe alerts the persons using the buzzer or vibration motor. It is more effective than blind stick and it provide a safe and secure feel. Ravindraiah et al., proposed an IoT Based Smart Shoe [5]. The shoes are multi utility shoes used for special purpose as a sensing device for the blind people. It is used widely to detect objects using ultra sonic sensor. If any object is present, the ultra-sonic sensor detects the object and sends the data to the Arduino.

3. METHODOLOGY

The primary goal is to propose a IoT Based Smart Shoe for the visually impaired people to provide an independent travel assistance without any panic. The shoe consists of ultrasonic sensors and vibration sensors connected to an Arduino UNO board. IoT technology has been the source of inventing the Smart Shoes at an affordable cost for the visually challenged people. These shoes are designed to provide a long-term solution for the visually challenged to walk on roads independently and reach the destination independently.

The proposed system harnesses the power of Internet of Things (IoT) technology to address the challenges faced by blind or visually impaired individuals. By integrating an electronic kit into Smart shoes, this innovative solution aims to enhance the mobility and safety of users. The

hardware kit comprises a single battery, a vibrate sensor, an objects detection sensor, and a Node MCU as shown in Fig 1. As users traverse their surroundings, the sensors automatically detect obstacles, triggering a vibrational alert in the shoes to notify individuals of potential barriers. This user-friendly system is specifically designed to cater to the needs of those who are visually challenged or blind.

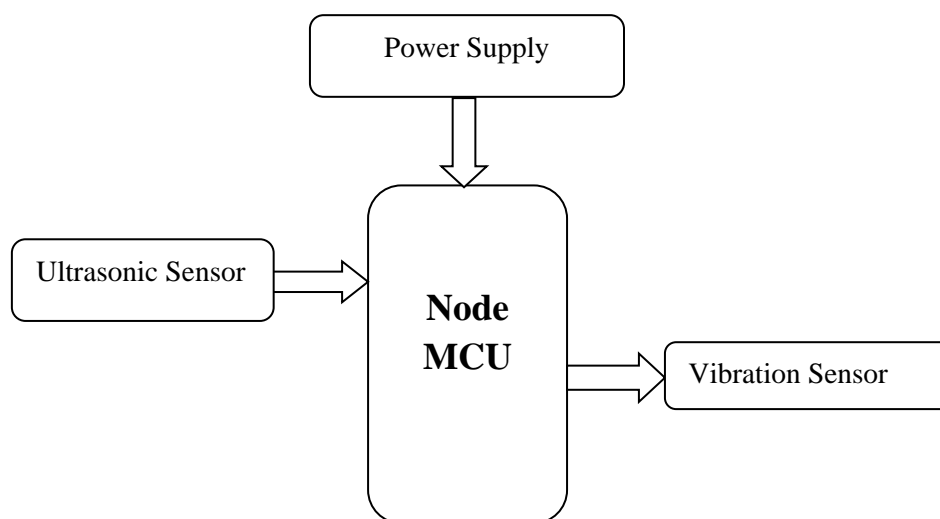


Fig 1 Obstacle Detection Block Diagram

The advantages of this system are multifaceted. Firstly, it serves as a reliable indicator of the right path, providing users with real-time feedback about their environment. Its simplicity of use ensures accessibility for a wide range of individuals, contributing to a seamless user experience. Importantly, the implementation of this smart shoe system is anticipated to result in a reduction of accidents, offering a heightened level of safety and security for users navigating their surroundings. Overall, the proposed system stands as a promising and practical solution, leveraging IoT to empower individuals with visual impairments and create a more inclusive environment

Node MCU

The Node MCU is open-source platform and it is used in the hardware development environment. It is low-cost SoC (System-on-a-Chip) called the ESP8266. It can be used to edit/modify/build. It also supports serial communication protocols. The Node MCU development board features Wi-Fi capability, analog pins, and serial communication protocols.

Node MCU is used as it is a more powerful processor with larger memory, and is capable of handling larger sketches and more intricate devices.

Ultrasonic Sensor

An ultrasonic sensor is a technological device that uses ultrasonic sound waves to measure a target object's distance and then turns the sound that is reflected into an electrical message. The speed of human hearing is greater than the speed of ultrasonic waves. The transmitter and the receiver are the two major parts of an ultrasonic sensor. It calculates the distance between the sensor and the object by measuring the time taken between the sound emitted by the transmitter and the contact with the sensor receiver. This sensor detects the obstacle of the path along with the distance and alerts the visually challenged.

Vibration Sensor

The vibration sensor is also called a piezoelectric sensor. The working principle of a vibration sensor is a sensor that uses various optical or mechanical principles to detect system vibrations as they are noticed. The vibration sensor alerts the visually challenged when any unusual circumstances are detected.

Power Supply

Lithium batteries are used for power supply as it has better lifetime and characterized by a higher specific energy, higher energy density as well as higher energy efficiency suitable for smart devices. It is a rechargeable battery which consists of reversible intercalation of Li⁺ ions for storing energy with 5 V.

4. RESULTS & DISCUSSIONS

The implementation of the proposed IoT-based Smart Shoes for Visually Challenged People, depicted in Fig. 2, successfully integrates ultrasonic and vibration sensors to detect obstacles. The ultrasonic sensor, strategically positioned in front of the shoes, coupled with vibration sensors within the shoes, effectively identifies obstacles in the surroundings. The power supply, managed by a 5V battery, ensures the continuous operation of the smart shoes. In practical terms, the system demonstrates its efficiency by swiftly detecting obstacles in a matter of

seconds and promptly alerting visually challenged individuals based on the direction of the obstacles.



Fig 2 Proposed IoT-based Smart Shoes for Visually Challenged People

The designed smart shoes represent a significant advancement in assistive technology for visually challenged individuals. The placement of ultrasonic and vibration sensors allows for comprehensive obstacle detection, facilitating a prompt response to potential hazards. The strategic positioning of the ultrasonic sensor in the front enhances the system’s ability to provide timely alerts. The inclusion of vibration sensors within the shoes ensures that users receive alerts in a manner that is intuitive and immediate.



Fig 3 Overall implementation of smart shoe

The overall implementation, as illustrated in Fig. 3, showcases a user-friendly design that aligns with the primary goal of aiding visually challenged individuals in navigation. By leveraging IoT technology, the system not only detects obstacles but does so rapidly, contributing to the

safety and independence of visually challenged individuals. The 5V battery power supply ensures the system's portability and reliability.

5. CONCLUSION

The proposed IoT Based Smart Shoes for Visually Challenged People is designed to allow visually challenged people to navigate around using the most recent technology. This system's primary objective is to aid people who are visually impaired with navigation. The shoe is user friendly and assists the visually challenged people to walk independently without any panic. It can be enhanced with a variety of sensors and other technologies that will aid the challenged people in finding their way to their destination. With the help of technology, it lends a helping hand to the visually challenged to lead a better life daily with confidence.

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